

**Team: Nick Holonyak, Jr., M. George Craford, and Russell Dean Dupuis**

**Brief Biography:** With applications in digital displays, consumer electronics, medicine, automotive lighting, traffic signals, and general illumination, the light-emitting diode (LED) is the world's most efficient light source being mass produced today. Professor Nick Holonyak Jr., Dr. M. George Craford, and Professor Russell Dupuis have made pioneering contributions and been leaders in developing and commercializing this revolutionary light source. Simply put: these researchers have done more to advance LED technology than any other team in the world.

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Holonyak, Craford,  
and Dupuis

Nick Holonyak Jr. invented the first visible LED (and semiconductor laser) in 1962, ushering in a new era in electronics and digital display technology. He was also the first to make III-V alloy devices (i.e. using elements from the third and fifth columns of the periodic table), which are now the basis for all heterojunctions and high-brightness LEDs.

Ten years later, M. George Craford invented the first yellow LED and 10 times brighter red and red-orange LEDs, expanding the potential uses of LEDs dramatically. He subsequently led the R&D efforts at Hewlett-Packard/Agilent Technologies/LumiLeds Lighting, which resulted in products that are now the highest-brightness LEDs available in the world.

In 1977, Russell Dupuis was the first to demonstrate that metalorganic chemical vapor deposition (MOCVD) could be used to grow high-quality semiconductor thin films and devices, including LEDs. Today, the MOCVD materials technology is the most widely used method for the high-volume production of LEDs worldwide.

The proven and anticipated economic effects of LED technology are nothing less than revolutionary. LED technology already dominates the indicator market: clocks, watches, medical equipment, printers, and so on. LED technology is rapidly taking over the automotive lighting and traffic signal markets. It is replacing neon bulbs in the signage industry, and can be expected to become the dominant technology for colored lighting of all kinds.

Upcoming high-efficiency/high-brightness LEDs promise to revolutionize lighting in general, in both exterior and interior applications. LEDs are already beginning to penetrate the low-power white-light market and in the long term will likely be important for general illumination. It is estimated that LEDs could save \$30 billion/year in energy costs in the United States alone, reduce the number of conventional coal- and gas-fired power plants that will be needed, and eliminate over 200 metric tons of carbon emission between now and 2020. Furthermore, unlike neon lighting products, LEDs do not contain mercury and are environmentally friendly.

